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ABSTRACT

To investigate the effects of training children in a specific learning facilitation skill, a study was devised that taught the association of the sounds of letters with their visual symbols. Twenty-six kindergarten children, 75% from low income homes and 75% of part-Hawaiian origin, were paired according to their pretraining scores on a letter discrimination labeling test and then randomly assigned to two groups. One group was trained on labeling the discriminative features of letter-like symbols, while the other group received no training. On a first posttraining labeling test, the trained group performed no better than the untrained group. Furthermore, a second test, administered by the individual who had trained the experimental group, did not reflect differences in performance. Following a no-feedback review of the testing stimuli, a third test indicated a significant increase for the trained group, in comparison both to their own previous performance and to the control group's performance. The score increases reflect the hypothesis of production deficiency whereby a small child does not spontaneously use certain acquired symbolic and conceptual skills to solve cognitive problems, implying that a child may know more than test scores indicate. (Tables are included.) (MAI)

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Technical Report #37

Production Deficiency of Labeling Skills in a Prereading Letter Discrimination Task

The Kamehameha Early Education Program

a research and development program established and funded by

The Kamehameha Schools/Bernice P. Bishop Estate

Ronald Gallimore, Roland G. Tharp & Gisela E. Speidel,
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The Kamehameha Early Education Program

The Kamehameha Early Education Program (KEEP) is a research and development program of The Kamehameha Schools/Bernice P. Bishop Estate. The mission of KEEP is the development, demonstration, and dissemination of methods for improving the education of Hawaiian and Part-Hawaiian children. These activities are conducted at the Ka Na'i Pono Research and Demonstration School, and in public classrooms in cooperation with the State Department of Education. KEEP projects and activities involve many aspects of the educational process, including teacher training, curriculum development, and child motivation, language, and cognition. More detailed descriptions of KEEP's history and operations are presented in Technical Reports #1-4.

Technical Report #37

Production Deficiency of Labeling Skills in a Prereading Letter Discrimination Task

Gisela E. Speidel Ramona K. Hao

Ronald Gallimore

Children in the early elementary grades do not always spontaneously use techniques that facilitate learning. Learning can then become much more arduous than it would necessarily need to be. The present study was concerned with training kindergarten children in such a learning technique. Specifically, we were interested in training children to label distinctive features of visual stimuli to expedite reading acquisition, especially learning to associate the sounds of letters with their visual symbols. Earlier observation had shown that a group of part-Hawaiian first graders had required on the average, 50 days or two and one-half months of daily instruction to acquire the 20 initial consonants (see Technical Report #26).

Previous studies suggest that the learning of letter sounds may be facilitated by first learning various distinctive features of the graphemes. For example, children asked to note distinctive features of letter-like forms, made fewer discrimination errors on a transfer task with different stimuli containing the same distinctive features (Pick, 1965). Samuels (1969) showed that prior training on the distinctive features of b, d, p, q produced faster learning of the respective letter names. In a similar investigation, Tawney (1972) reinforced one group of young children for responding to critical features of letter-like stimuli and another group for responding to noncritical features. Children in the critical features group made

significantly fewer discrimination errors on a posttest with real letters.

Research in the area of memory suggests that using verbal labels expedites recall in children as well as in adults (Bernback, 1967; Kurtz and Hovland, 1953). Similarly, attaching verbal responses to stimuli during training aids discrimination (Schaeffer and Gerjoy, 1955; Weir and Stevenson, 1959). Weir and Stevenson (1959), for example, found that both younger and older children learned to discriminate between two visual stimuli more quickly, if asked to name the stimulus to which they were responding. Pyles (1932) presented children with five nonsense shapes, one of which always concealed a toy. The task was to find the shape that had the toy. The group of children that were provided with names for each of the nonsense shapes learned in half the number of trials that the control group required.

The above studies suggest that the learning of grapheme-phoneme pairs can be furthered by prior discrimination training of critical features and by the teaching of labels for these discriminative features. To see whether in a classroom setting the ability to label differences among letters is actually related to reading level in the early first grade, we developed a letter discrimination labeling test. The test is described in some detail below. The score on this labeling test was significantly related to the reading achievement of a group of beginning readers even when IQ was held constant statistically ($r_{xy.z}(26)=.32$; $p=.05$).

The present study sought to investigate the first question, namely, whether it is possible to train children to label distinctive features of letter-like symbols and whether this skill then transfers to labeling differences amongst letters.

Kindergarten children, just beginning initial consonant training in their regular classroom instruction, were pretested on the labeling test

and, on the basis of the test scores, assigned to a training or a control condition. The training consisted of teaching labels of letter-like stimuli which contained the same critical features as the letter pairs of the labeling test. The effect of discrimination-labeling training was then assessed on a posttest administration of the labeling test.

A second study was conducted with the same children approximately two weeks after completion of Study I. It consisted of different prompting cues to facilitate generalization from the training stimuli to the testing stimuli.

Study I

Method

Subjects

Twenty-six kindergarten-aged children participated. They were beginning to learn initial consonant sounds in their regular class curriculum. The children all attended a research and development school. They were selected randomly with the restrictions that 75% come from low income homes and 75% are of part-Hawaiian origin (see Technical Report #13). The children were paired according to their pretest score on the letter discrimination labeling test to equate preexperimental performance on the test. Members of each pair were then randomly assigned to the two conditions. During the course of the experiment, three pairs of children were dropped because of prolonged absences of one of the members of a pair. The mean labeling score of the final experimental group was 8.8, and the mean of the control was 8.7.

Materials

The labeling test. The labeling test was used to measure the effectiveness of the distinctive feature labeling training. It was given to both groups, control and experimental, as a pretest and as a posttest. The test consisted of 10 pairs of letters presented on index cards. Each pair contained at least one critical discriminating feature. The total number of

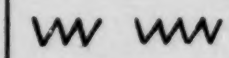
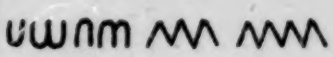
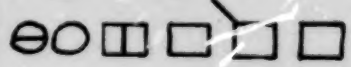
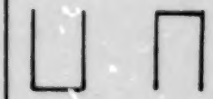
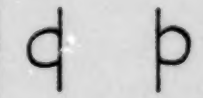
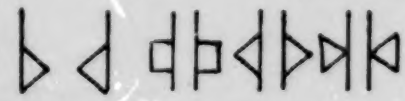
possible critical discriminations was 12. However, only seven basic types of discriminations, for example, "on top" and "on the bottom" were included. Thus, some of these basic discriminations were tested twice. There were three possible scores for each discrimination depending on the level of description of the distinctive feature: a score of zero was given for inability to verbalize the distinction, while a score of two was given for a succinct and well-formulated description. A score of one was assigned to an acceptable, but poorly formulated description of the difference. For instance, for V and W a two point answer might be: "One has one hump and one has two humps." A one point answer might be" "This (W) like this (points to V) but has this (and makes motion of completing V to make a W out of it)." However, if a child merely traces letters he does not get a point.

The training materials. The training materials were chosen in order to provide the children with instructions on the seven basic discriminations contained in the labeling test. The symbols and articles used for the training sessions were at times similar to the letters on the test, but actual letters were never used. For example, to train the orientation differences of the horizontal axis, were used rather than b d; to train discriminations in which repeated units differed in frequency the stimuli and were used. Table 1 presents a summary of the discriminations that were trained and the stimuli that were used in training.

Table 1

Discriminations and Corresponding Symbols

Used for Training

Number	Discrimination	Main Symbols	Other Symbols Used
1	Number of humps		
2	Line on top vs. line on bottom		tinkertoys
3	Large vs. small		
4	Line vs. no line		
5	Straight line vs. curved line		
6	Rightside up vs. upside down or Facing up vs. facing down		cans, bottles pictures
7	Facing one way vs. facing the other way		

Procedure

Pretest. The children were tested individually on the labeling test. Each subject was presented with one pair of letters at a time and asked "How do these look different?" If a child responded with the name of the letter, his response was acknowledged but he was asked again how the letters looked different. On items on which there was more than one discrimination possible, subjects were asked after their first response whether anything else looked different.

Training sessions. After assignment of the pairs to either experimental or control conditions, the experimental group was given training on labeling the critical features of various letter-like stimuli, while the control condition continued their regular classroom activities. The training consisted of teaching the seven basic discriminations.

The experimental children were placed into three homogeneous groups on the basis of their pretest scores. Each group received daily training sessions of approximately 10 minutes in length until all members of a group reached criterion, that is, were able to label the distinctive features of the seven basic stimuli pairs without prompts. Detailed lesson plans were made for each discrimination to insure constant training procedures across all three groups. The stimuli used for each discrimination are shown in Table 1.

A single discrimination was taught until all members could verbalize the relevant feature. Each session, discriminations learned on previous days were reviewed.

The first group required 11 sessions, the second group 17 sessions, and the third group 16 sessions.

Posttest. When all members of a training group had reached criterion, they and their partners in the control condition were given the labeling test

again. This procedure meant that the training group which had reached criterion after only 11 sessions was posttested at an earlier date than the remaining two groups. The administration procedures were identical to those of the pretraining administration.

Results and Discussion

The mean pre- and posttest scores on the labeling test for the experimental and the control groups are shown in Figure 1. Both groups had improved significantly from the first to the second administration of the test (experimental group: $t(9)=2.30$; $p<.05$; control group: $t(9)=2.39$; $p<.05$). The experimental group scored no higher on the posttest than the control group, indicating that the special training given to the experimental group did not result in an increase in a more generalized labeling skill. The increase found in both groups of children may have been the result of nonspecific training in the classroom, greater familiarity with the test, or maturational factors.

Study II

The finding of Study I which showed that the experimental subjects had not improved above and beyond the control condition was perplexing. The instructor of the experimental group felt that the children had learned the discriminations and their labels well and was puzzled that the trained children did not apply their knowledge on the test. An unpublished study with a different sample of children from the same population as the present ones suggested that these children would generalize more readily knowledge gained in a classroom instruction setting to a test setting when the tester was the same individual as the original instructor (see Technical Report #30). Thus, it was decided to test the children once again on the labeling test, but this time with the same individual who had given the training sessions.

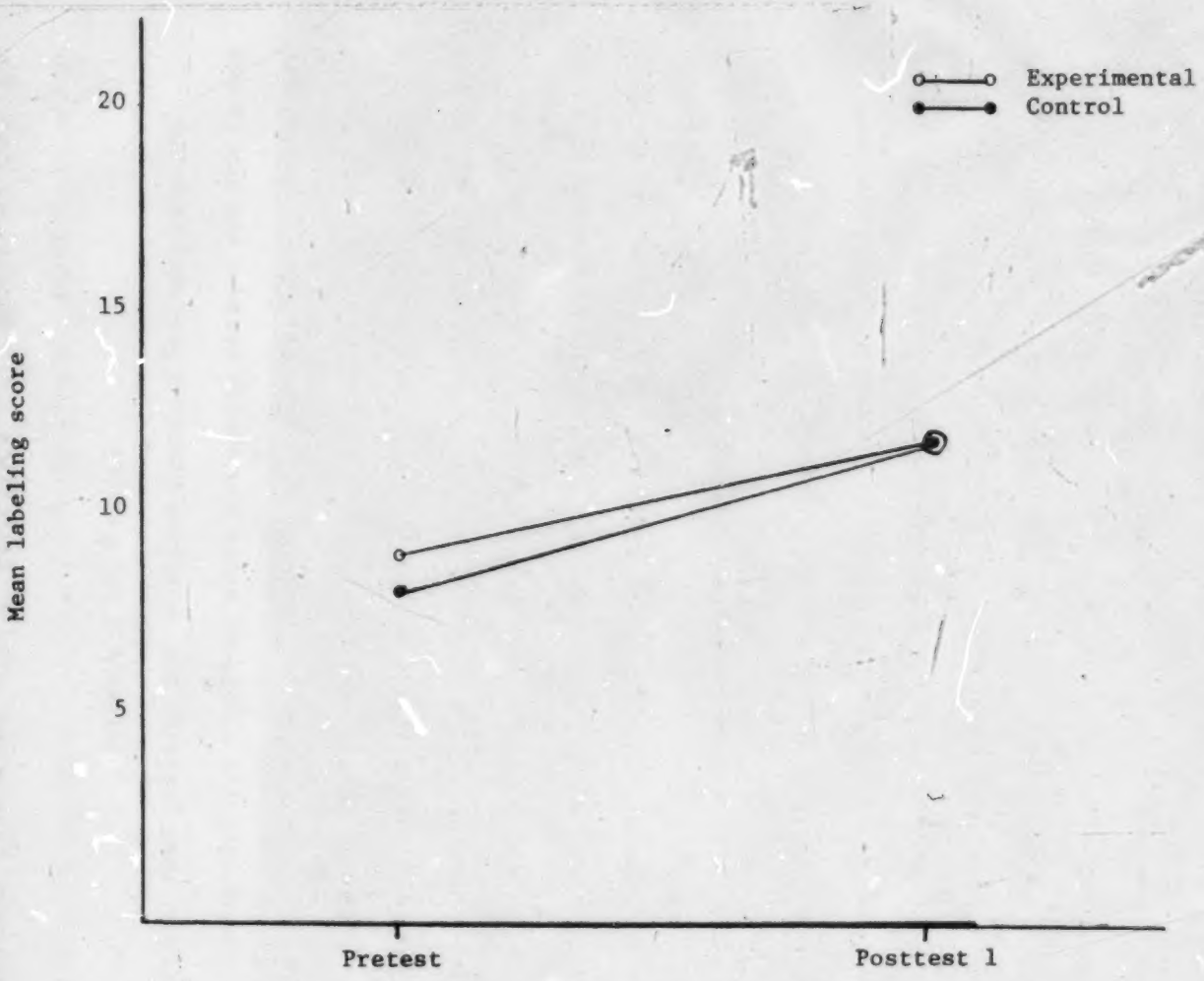


Figure 1. Mean labeling scores for experimental and control groups on pretest and posttest 1.

Subjects

The subjects were the same 10 pairs of children who constituted the final sample of Study 1.

Materials

The materials consisted of the labeling test and the major training stimuli.

Procedure

Posttest 2. The experimental and the control children were tested on the labeling test by the same adult who had carried out the training for the experimental chidlren. The control was also very familiar with this adult who was their regular classroom teacher for part of the school day. The test was administered in identical fashion to that described for Study 1.

Review of training stimuli. Immediately after Posttest 2, the experimental children were presented with the original seven pairs of training stimuli that had been used to teach the basic discriminations and their labels. The pairs were presented one by one and the children were asked, "How are these two different?" No feedback was given to the subjects regarding the accuracy of their responses. This review took less than five minutes.

During this period, the control group was shown no stimuli. The instructor merely chatted with them about their recent vacation experiences.

Posttest 3. The labeling test was administered by the instructor again immediately after the five minute Posttest 2 - 3 interval.

Results

The mean scores on the discrimination test on Posttest 2 and 3 are given for both groups in Figure 2. A comparison of the mean scores on Posttest 1 and 2 shows that both groups retained their labeling skill during the interim period that ranged from 2 - 4 weeks. On Posttest 2 the two groups were still not significantly different from each other ($t(9)=.16$; $p > .10$).

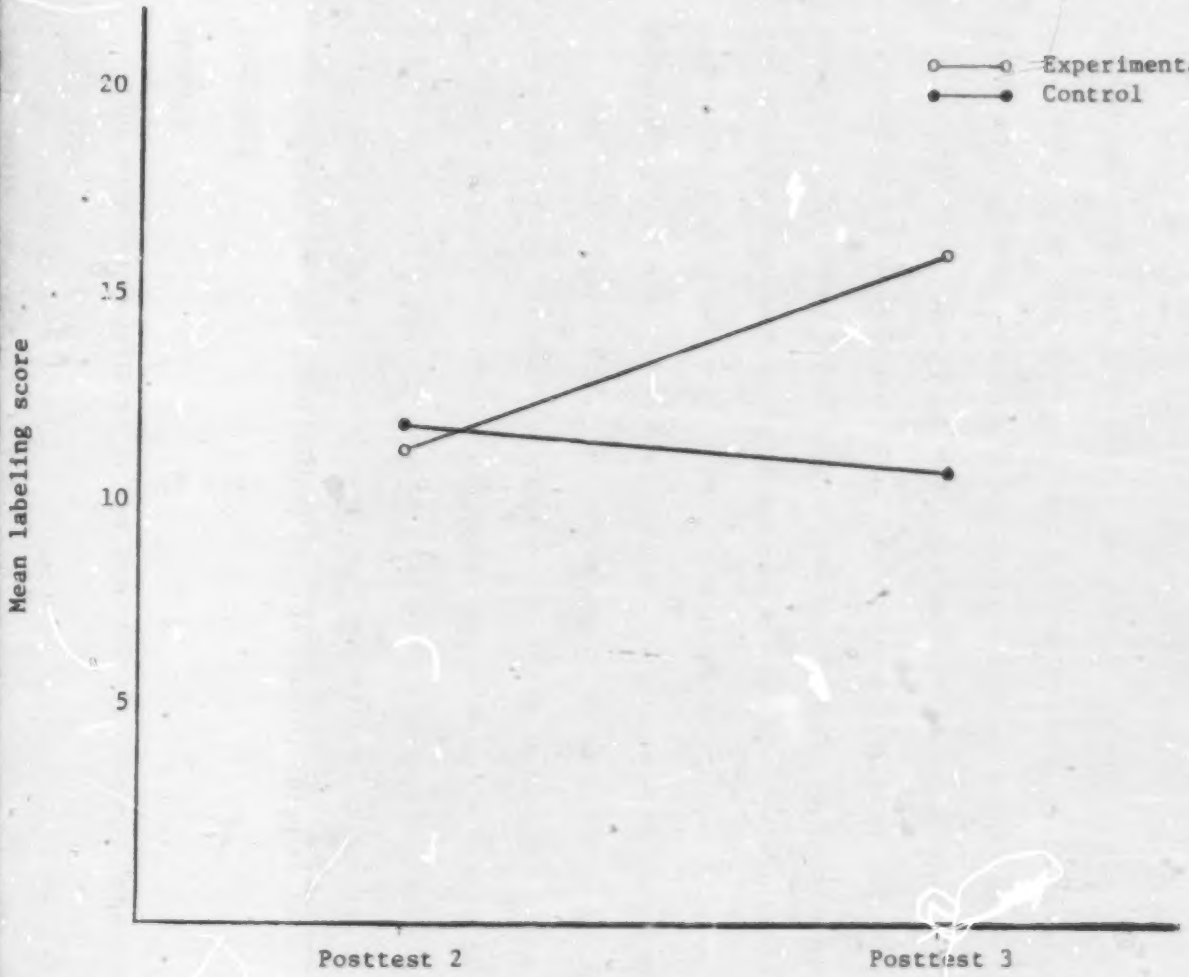


Figure 2. Mean labeling scores for experimental and control groups on posttest 2 and posttest 3.

The changes that occurred on Posttest 3 are also shown in Figure 2. On Posttest 3, the experimental group increased in performance while the control group's scores decreased somewhat. The difference between the two groups was now significant ($t(9)=3.16$; $p<.01$). The difference is due mainly to the increase found in the experimental group from Posttest 2 to Posttest 3 ($t(9)=3.13$; $p<.02$). The decrease in the control group was not significant ($t(9)=1.80$; $p>.10$).

Discussion

The significant increase of the trained group on Posttest 3 cannot be attributed to practice effects, because the control group received the same number of test sessions, and showed no further increase after the second test session.

Experimenter bias cannot be completely ruled out as a possible explanation of the increase for the trained group. However, it is not very plausible. Had the experimenters' expectancies influenced the results, one would have predicted this influence to be especially noticeable on Posttest 2, which was the first time the tester was the teacher. Yet, on Posttest 2 there was no evidence of experimenter bias--both groups had nearly identical scores.

This sudden improvement on Posttest 3 in the trained group resembles the phenomenon resulting from what has been coined production deficiency (Flavell, Beach, and Chinsky, 1966). Flavell found that younger children have verbal mediators and labels available, but do not make spontaneous use of them. Such children, however, can be induced to use verbal mediators to assist their short term recall. The production deficiency hypothesis essentially states that there is a stage in development in which a child tends not to use spontaneously, certain symbolic and conceptual skills to cope with cognitive tasks, although the skills are in his repertoire.

Such so-called production deficiencies have been found to occur for a

variety of tasks. For instance, Moely, Olson, Halwes, and Flavell (1969) discovered that younger children did not spontaneously rearrange pictures of objects and animals into groups by conceptual category to facilitate their subsequent recall. However, when given cues or instructions, the children were able to construct such groupings and thus improve their recall. Corsini, Pick, and Flavell (1968) found production deficiencies occurring for nonverbal mediators. Children were asked to reproduce patterns constructed of wooden forms from memory. They were given paper forms identical to the wooden forms which they could use as mediators to copy the original wooden patterns. With the help of these paper copies, the children could reconstruct the original pattern. Younger children, in contrast to older ones, did not make spontaneous use of the paper forms. Yet, when given appropriate hints, the majority were able to use the paper forms as facilitating mediators. A similar finding occurred in using color cues to make recency judgements (Brown, Campione, and Gilliard, 1974). Older children used the available cues without instructions while younger children needed explicit instructions before using the cues to perform the task.

The behavior of the trained group of the present study closely resembles the production deficiency phenomenon: no evidence of a training effect was found in the testing situation until introduction of contextual and temporal cues.

Since production deficiencies have been noted mainly with younger children, they may have a maturational basis, and may spontaneously disappear with age. An alternative explanation is that older children have had more learning experiences in using mediators to solve tasks.

Assuming at least a partial learning basis for effective application of mediators, the present study and the production deficiency findings have implications for teaching and testing. The significance for teaching is

that a concept should be instructed in a variety of contexts to hasten its wider application. Not only should different stimuli be employed, but also a variety of stimulus presentations and environmental contexts, such as varying the instructors and the subject area. After repeated experiences of such a nature, a child may learn to automatically use newly acquired skills in a wider range of settings. At that point, such generalized training methods would no longer be necessary.

In regard to assessment of skills and achievement, the implications of the production deficiency phenomenon indicate that a child may know significantly more than his test results would suggest. Introducing appropriate cues may elicit further knowledge. This point may be particularly relevant to minority group children whose teachers frequently complain that these children do not generalize and that they do not perform on school achievement tests according to their ability.

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